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Prediction of seasonal sea level anomalies within the Bureau of Meteorology

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Outline

Why should you care about seasonal sea levels?

How good are the Bureau of Meteorology's seasonal predictions of sea level anomalies and why?

How can you access the seasonal predictions of sea level anomalies?

Seasonal prediction of global sea level anomalies using an ocean-atmosphere dynamical model

Elaine R. Miles, Claire M. Spillman, John A. Church, Peter C. McIntosh

Climate Dynamics (2014) DOI: 10.1007/s00382-013-2039-7

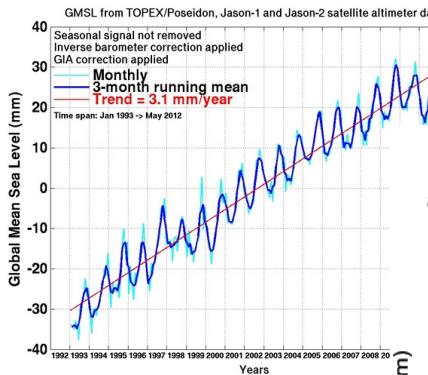
Seasonal coastal sea level prediction using a dynamical model

Peter C. McIntosh, John A. Church, Elaine R. Miles, Ken Ridgway, Claire M. Spillman

Geophysical Research Letters (2015) DOI: 10.1002/2015GL065091



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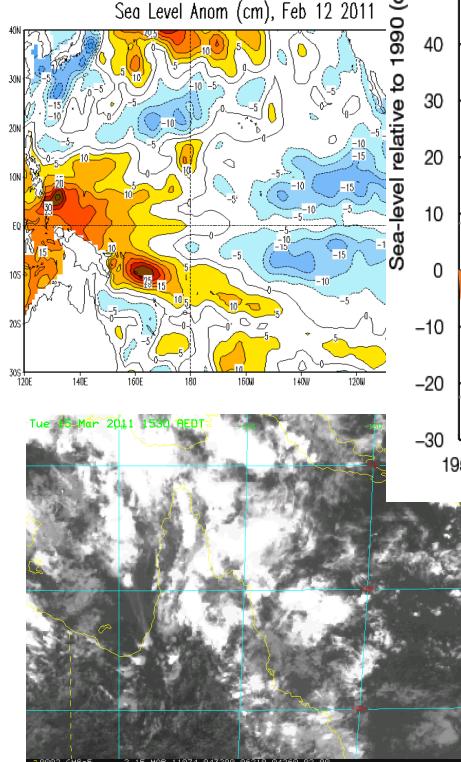


Seasonal

Sea level extremes

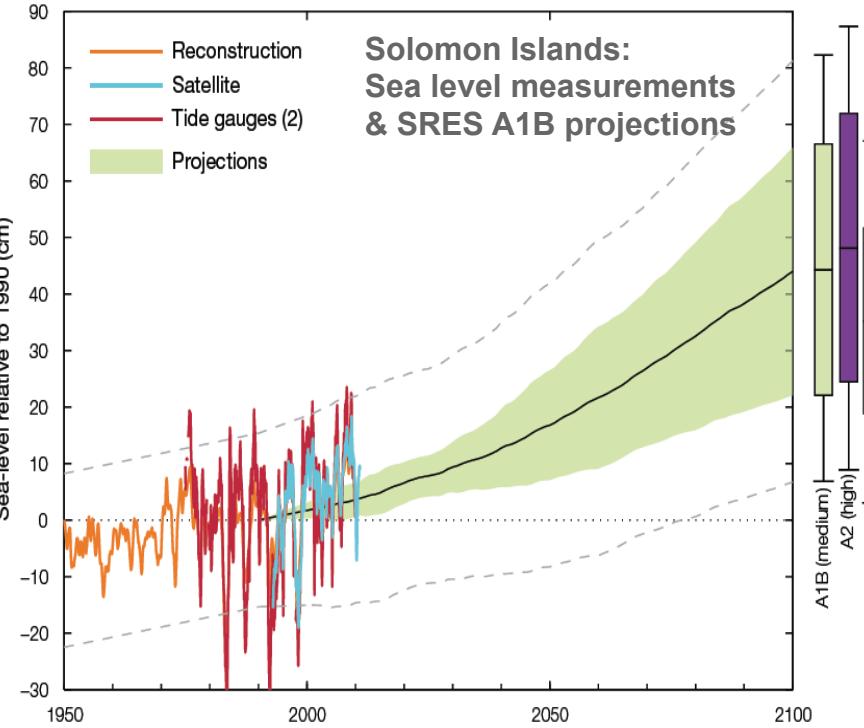


Tuvalu



Weather
+
Tides

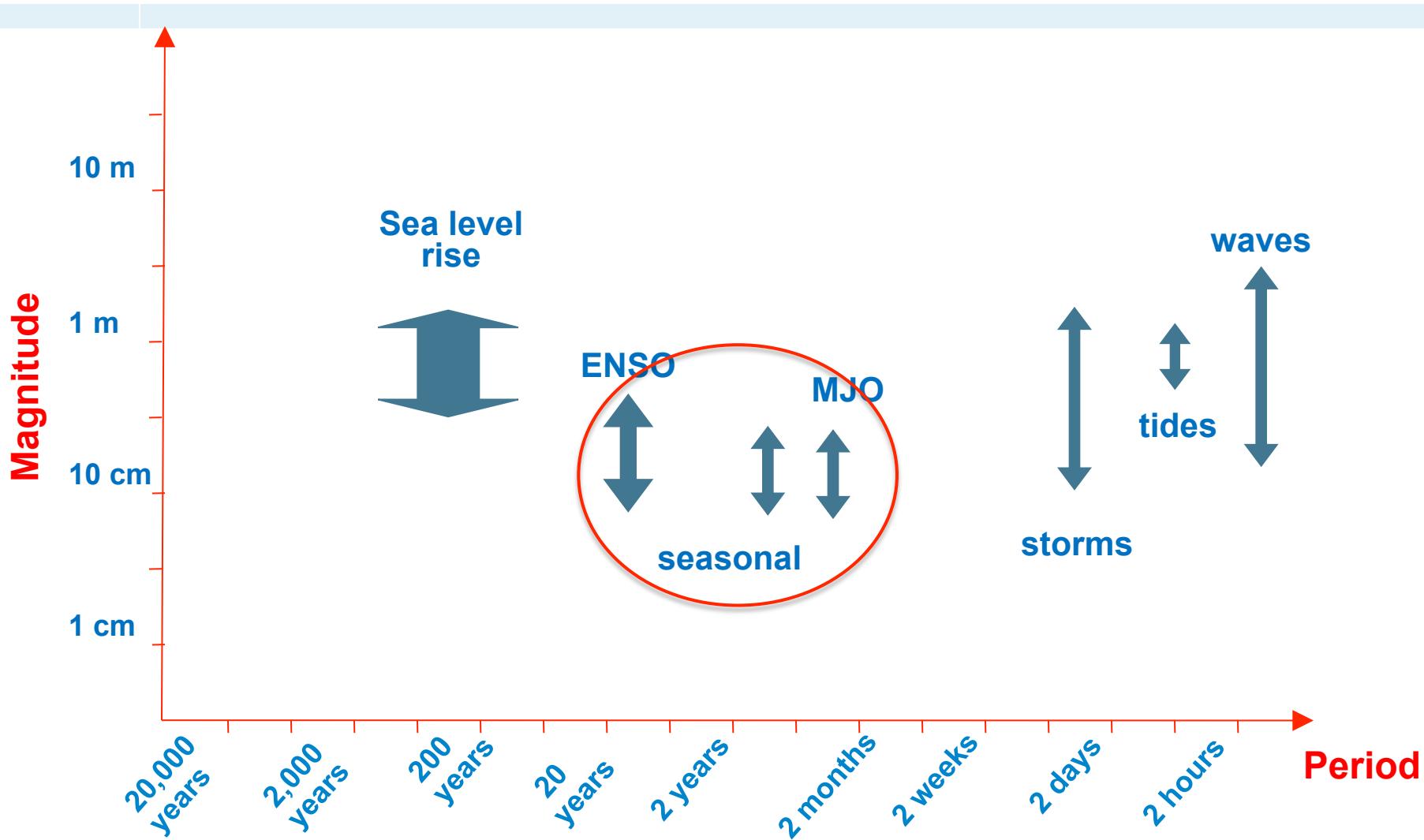
Solomon Islands: Sea level measurements & SRES A1B projections



Fiji



Filling in the gaps in sea level forecasting





Pacific-Australia Climate Change Science and Adaptation Planning Program (PACCSAP): Seasonal prediction of SLA project

In recognising that climate change impacts will be significant to Pacific nations and the limited regionally-specific information available seek to:

- Create **strong science base** for understanding seasonal sea level variability and predictability.
- A report on the **assessment of the skill** of seasonal predictions of sea level anomalies (SLA) for the Western Pacific region.
- Development and launch of a suite of **experimental seasonal SLA forecasts**.

Creating:

- Opportunities for better coastal zone management and thus enhanced resilience under climate change.
- Improved community and stakeholder awareness of how climate influences the coastal zone.





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Pacific Partner Countries



Cook Islands
East Timor
Federated States of Micronesia
Fiji
Kiribati

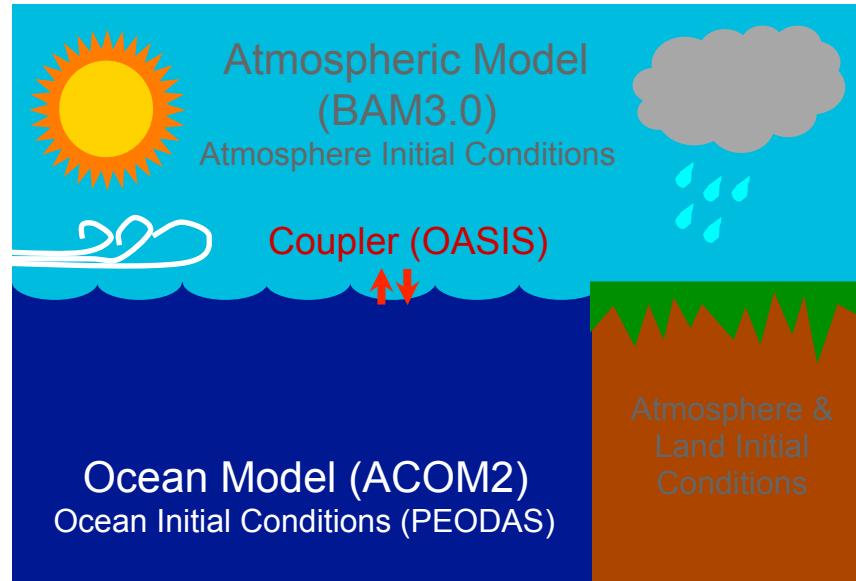
Niue
Palau
Papua New Guinea
Republic of Marshall Islands
Republic of Nauru

Samoa
Solomon Islands
Tonga
Tuvalu
Vanuatu



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Predictive Ocean Atmosphere Model for Australia (POAMA)



<http://poama.bom.gov.au>

OCEAN MODEL: GFDL MOM2

- 2° zonal $\sim 0.5\text{--}1.5^\circ$ from equator to the poles.
- 25 vertical levels with a maximum depth of 5 km.

OCEAN Initial Condition: PEODAS

Assimilates in-situ T and S observations from CTD, XBT (T only), TAO/TRITON/PIRATA, Reynolds and Argo.

MULTI-MODEL MODE

3 different model configurations, each with 11 ensemble members.



Method

Evaluate skill of POAMA, a **DYNAMICAL COUPLED MULTI-MODEL-ENSEMBLE SEASONAL PREDICTION SYSTEM**, to model seasonal SLA using...

- POAMA hindcasts, Jan 1981 – Dec 2010
- Altimeter record with GIA, GT and IB removed (Church et al. 2004, (CSIRO), Jan 1993 – Present
- Tide gauges, (available period site dependent)

Notes on POAMA...

- ❑ No data assimilation of sea level.
- ❑ Rigid Lid i.e. Volume is conserved.
 - ❑ No global trend.
 - ❑ No glacial isostatic adjustment correction.
 - ❑ No height from atmospheric pressure – Inverted Barometer effect



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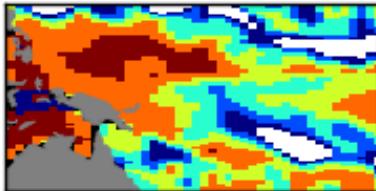
Model Skill Targeting Summer and Winter

Dec-Jan-Feb

Jun-Jul-Aug

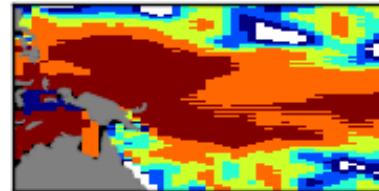
Persistence

LEAD = 1 MONTHS, START = NOV



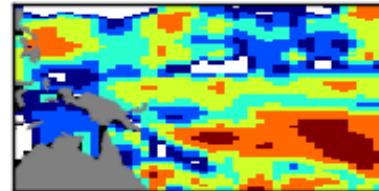
POAMA

LEAD = 1 MONTHS, START = NOV



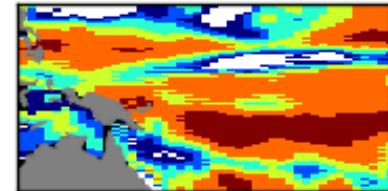
Persistence

LEAD = 1 MONTHS, START = MAY



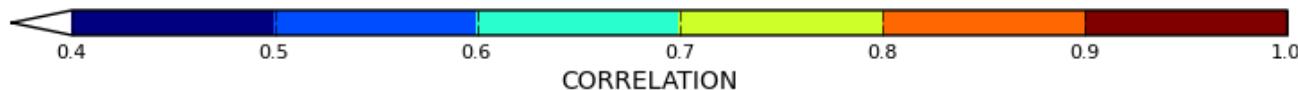
POAMA

LEAD = 1 MONTHS, START = MAY



1 month in advance

6 months in advance

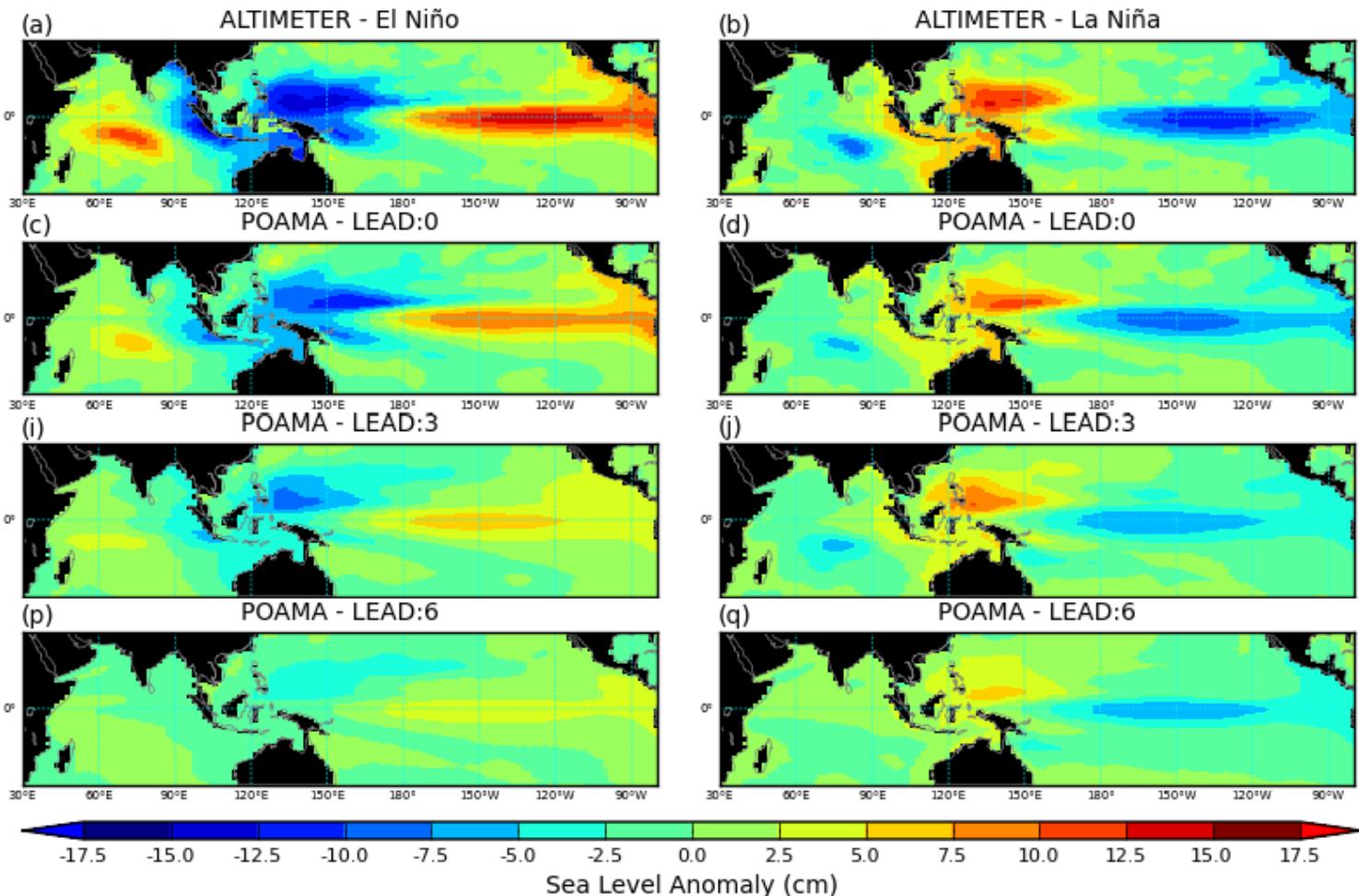




ENSO events

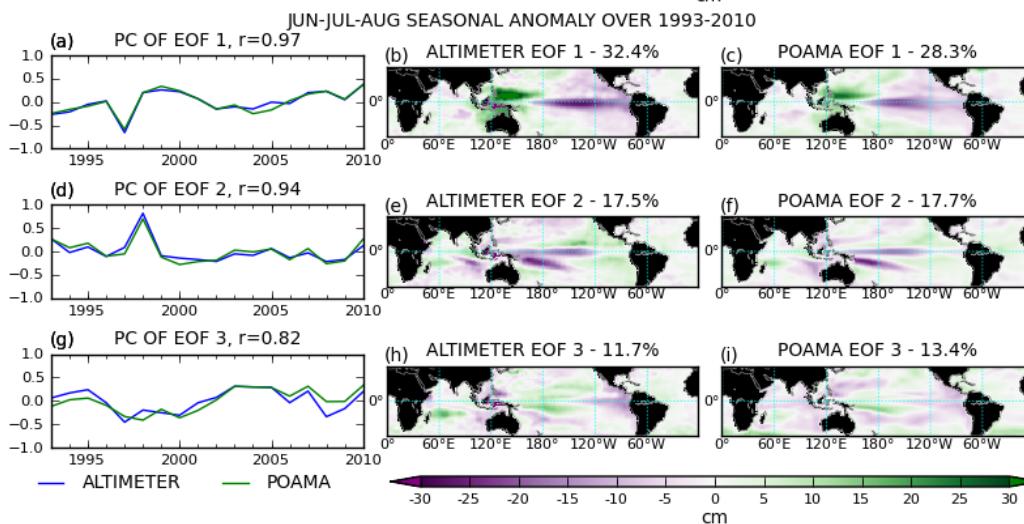
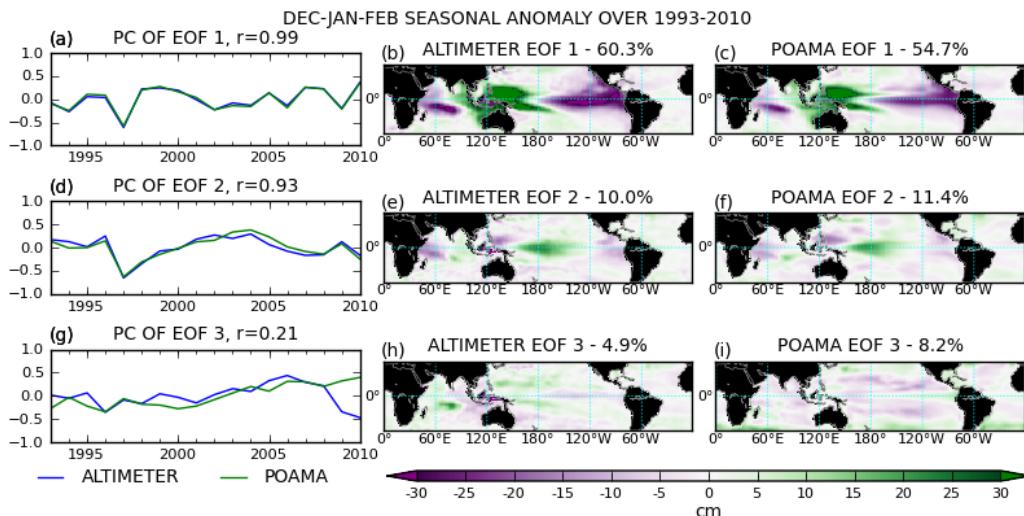
El Niño	La Niña
1994	1995
1997	1998
2002	1999
2006	2007
2009	2010

Average of seasonal SLA
for five mature phases of
El Niño and La Niña
between the years
1993-2010.





EOF Analysis Altimeter and POAMA



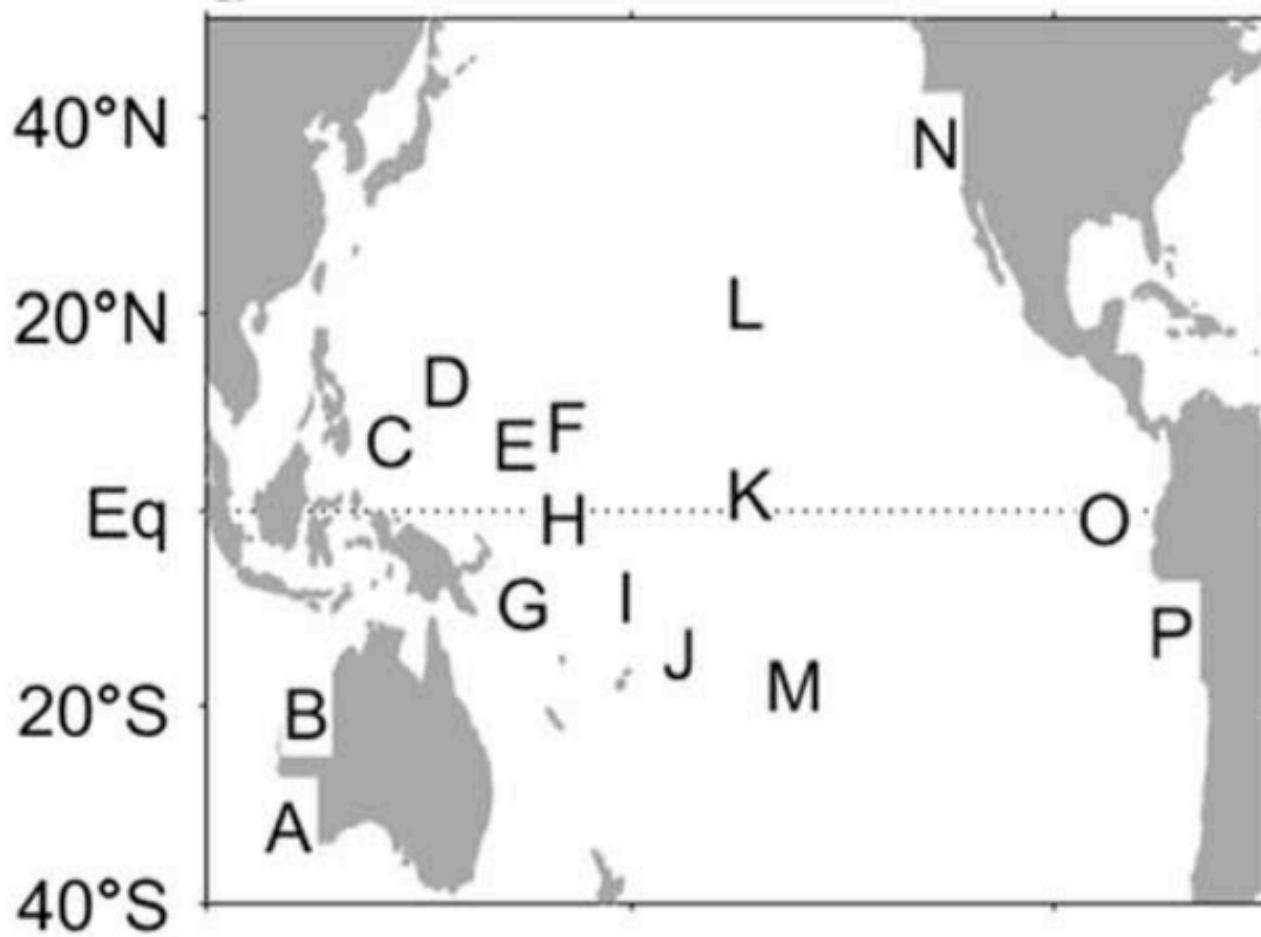
During DJF EOF 1 is dominated by ENSO pattern.

This pattern is balanced by reloading pattern in JJA.



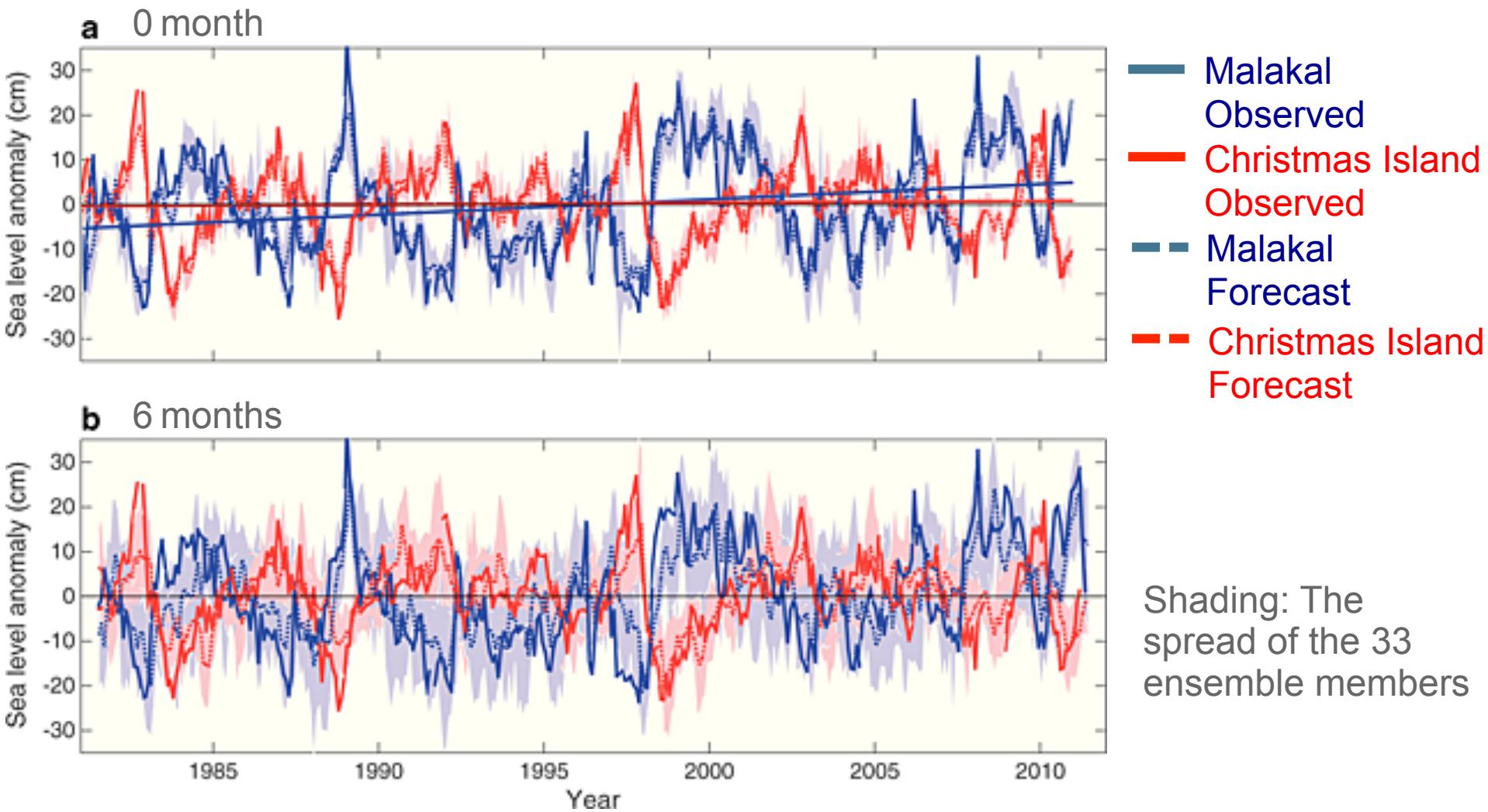
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Comparison with tide gauge stations

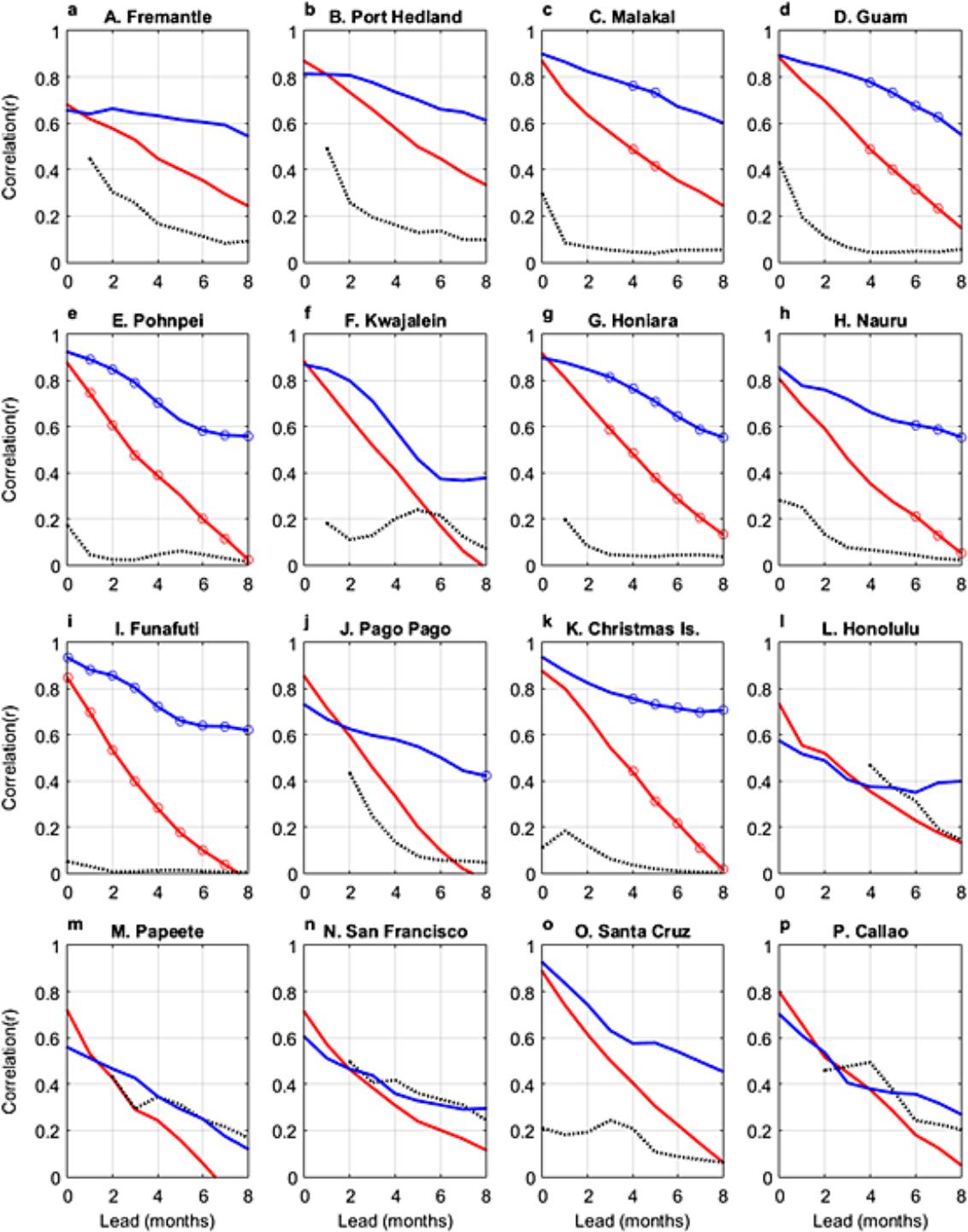




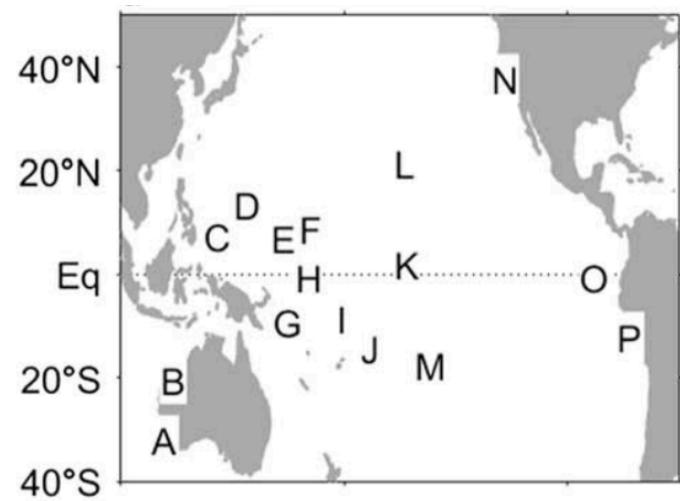
Time series SLA from POAMA and tide gauges



Skill at the coastal level



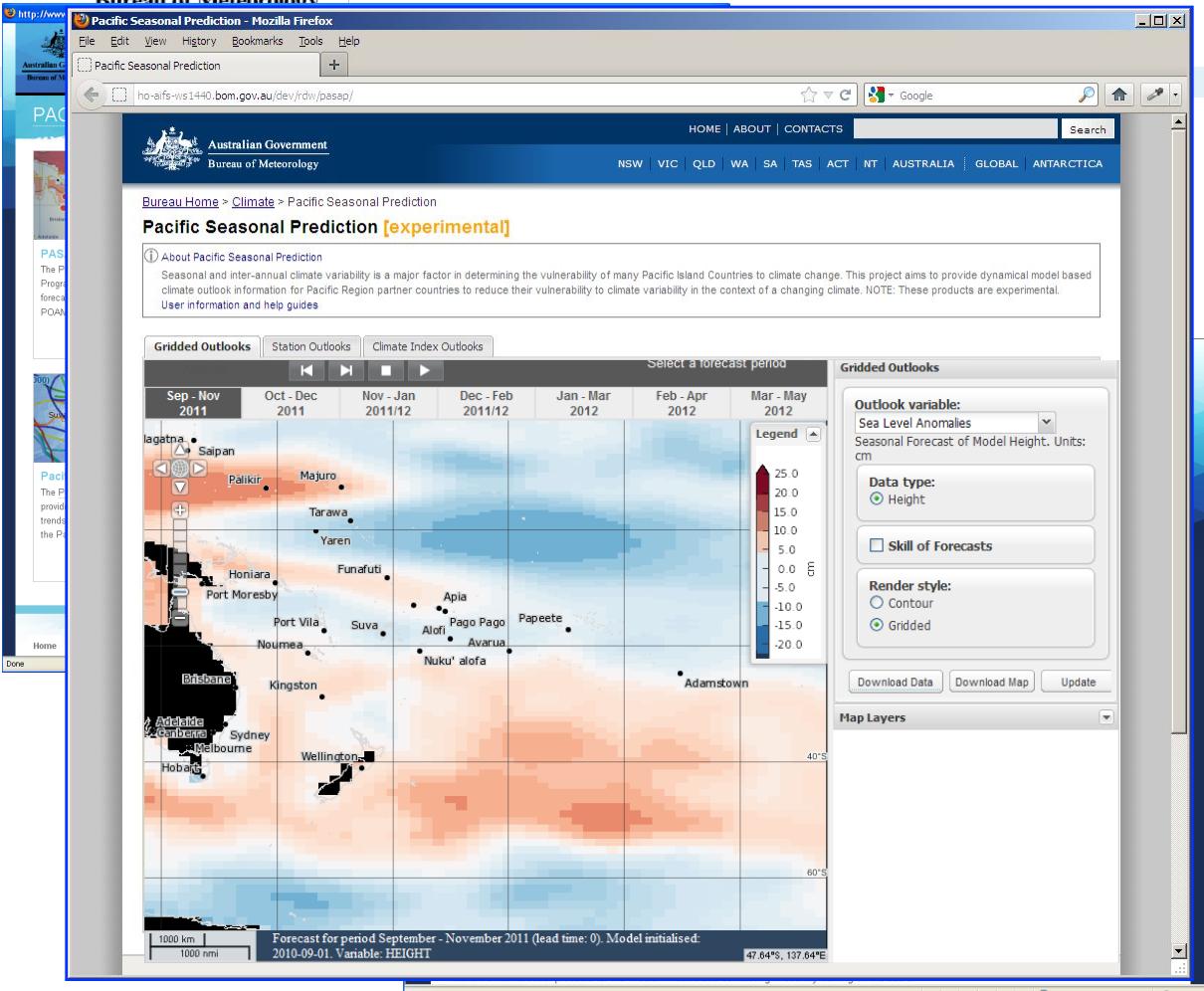
POAMA ensemble mean forecast
and tide gauge observations
Persistence forecast and
observations





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Forecast Delivery

Online portal to deliver seasonal sea level forecasts for the Western Pacific

Available experimental forecast products:

- Sea height anomalies.
- Probabilities.
- Country indices.
- Skill for all forecasts.

<http://www.bom.gov.au/climate/pacific/>



Summary

- Extreme sea level events are a combination of global trend, seasonal events and weather events.
- POAMA shows good skill against tide gauge stations and altimeter observations, beating persistence.
- POAMA captures phase, variability and physical processes in Western Pacific.
- POAMA is able to forecast seasonal sea level anomalies with high skill out to 7 months in Western Pacific.
- First experimental dynamical seasonal prediction of SLA in the world!
- Online portal available!



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Thank you

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and Energy Efficiency



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